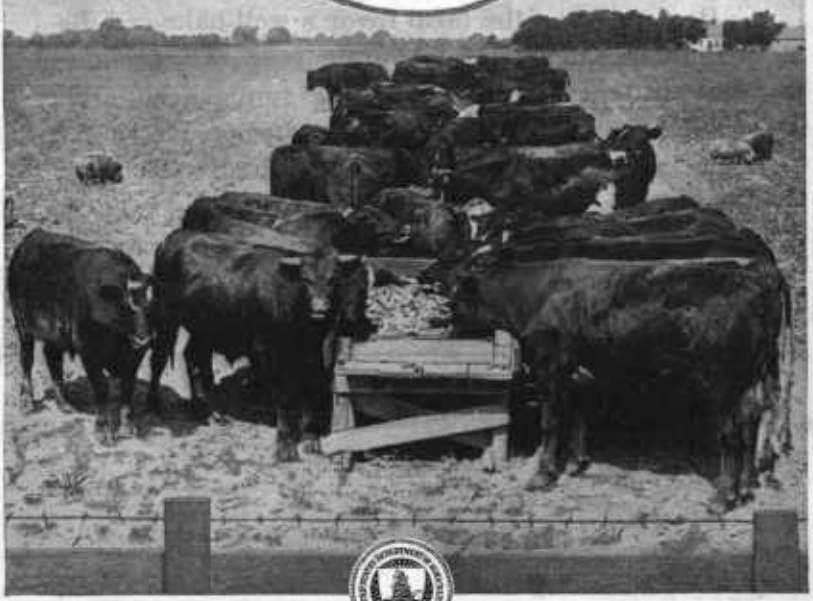
FARMERS' BULLETIN 1218
UNITED STATES DEPARTMENT OF AGRICULTURE

BEEF PRODUCTION in the CORN BELT



BEEF CATTLE AN ASSET TO THE FARM.

THE USE of beef cattle in connection with general farming throughout the Corn Belt offers the following advantages:

It is possible to make greater use of dry roughages produced on the farm, as beef cattle consume larger quantities of these feeds than any other class of livestock.

Beef cattle can be used profitably on rough land unsuitable for crop production; also on low, wet land unsuitable for either crops or for other classes of stock.

Beef cattle can use the total production of grain and roughages on the average farm, without the purchase of other feeds, more efficiently than any other class of livestock.

Beef cattle on the farm favor a well-balanced distribution of labor throughout the year. They require very little attention during the summer and fall, when crops need attention, and during winter and early spring, when there is little field work to be done, farmers can utilize their time to advantage by caring for the breeding herd, wintering the stockers and feeders, or fattening some steers.

Contribution from the Bureau of Animal Industry
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Washington, D. C.
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BEEF PRODUCTION IN THE CORN BELT.[1]

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I. PRODUCING FEEDERS IN THE CORN BELT.

The general tendency in the Corn Belt to plow up permanent pastures and produce more cultivated crops caused a decline in raising beef cattle. Farmers changed from raising their feeders to buying those raised in other areas, principally on the western ranges. However, the keeping of cows to raise calves has continued to be profitable in many sections, on large areas of land too rough, too wet, or too infertile for cultivation.

The loss of permanent pasture has been compensated for to some extent by the greater use of clover and alfalfa in crop rotations and the use of silage in times of drought. However, silage has been used chiefly in winter feeding. The large amount of legume hay, straw, and stover produced in grain farming has favored the keeping of cows to raise calves.

Since about 1905 the breaking up of the western ranges for dry farming and irrigation has tended to increase the production of feeders in the Corn Belt. Increased freight rates have added much to the cost of feeders from other areas. Consequently many Corn Belt farmers find it profitable to raise their own feeders.

[1] This bulletin supersedes Farmers' Bulletin 588, "Economical Cattle Feeding in the Corn Belt."

FEED REQUIRED TO WINTER A COW.

An investigation [2] was carried on for three years (1914–16) on 906 farms to determine the cost of raising cattle in the Corn Belt. It was found that feed represented 69 per cent of the gross cost of keeping a cow for one year, while all other factors, including interest, labor, equipment, and incidentals, amounted to 31 per cent. It was not necessary to allow for depreciation, because it was found that cows weighed enough more when they were sold at from 7 to 8 years of age than when they were put into the breeding herd as heifers, to offset the decreased value per pound.

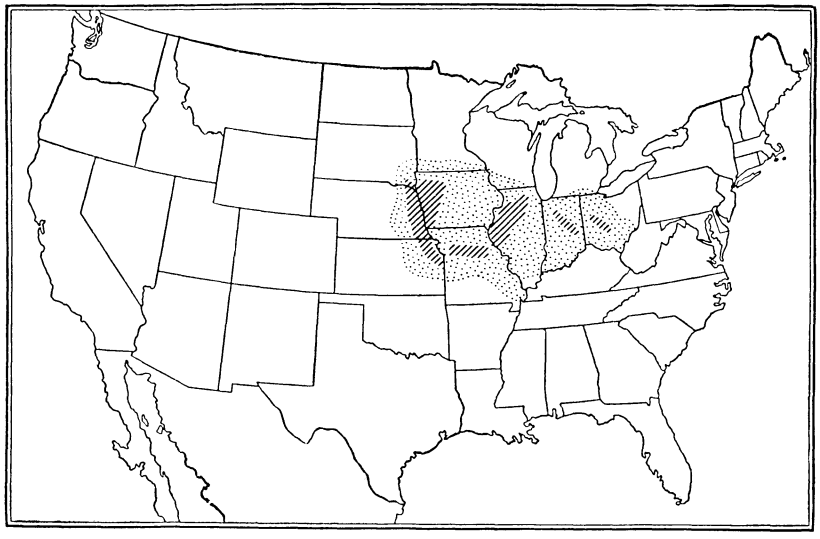

FIG. 1.—The outlined area shows the position of the Corn Belt proper, where live-stock farming and corn growing are very closely related. The heavily shaded portions indicate in a general way the area in each State where the fattening of steers is carried on most extensively.

The average number of cows per farm was 25. The average number of cows per bull was 22. The per cent of calves raised for the 23,258 cows included in the investigation was practically 85.

The average quantities of feed and pasture consumed by one cow during a winter feeding period of 5½ months, based on records taken from 354 farms where cows were kept strictly for raising stockers and feeders, are given in Table 1.

TABLE 1.—*Average quantities of feed and pasture consumed by one cow during winter period.*

Grain	122 pounds	Corn fodder	0.12 acre
Hay	1,900 pounds	Cornstalks	1.6 acres
Silage	700 pounds	Corn stover	0.24 acre
Straw	660 pounds	Winter pasture	4 days

[2] This investigation was carried on cooperatively by the Bureau of Animal Industry and the Office of Farm Management. The results are published in Report 111, Office of the Secretary, U. S. Department of Agriculture, and Part VI of the Report of the Federal Trade Commission on the meat-packing industry.

By applying local prices to the feeds and winter pasture listed in Table 1, and to the acreage of pasture required to carry a cow through the summer in any particular locality, one can readily determine the cost of keeping a cow one year. To find the cost of raising a calf to weaning age, when an 85 per cent calf crop is expected, divide the cost of keeping a cow by 0.85. To this result add the bull charge, which is obtained by dividing the cost of keeping a bull (50 per cent higher than that of keeping a cow) by the number of cows per bull. If the calves are fed grain before weaning, allowance should be made for approximately 150 pounds per head. The final result is the cost of the weanling calf.

FACTORS INFLUENCING COST OF PRODUCTION.

Increasing the credits from the beef cows, improving the breeding herd, and economical feeding are factors upon which economical production depends.

INCREASING THE COW CREDITS.

Systems of handling the herd that would insure credits other than that of the calf would tend toward lowering the cost of calf production. This might be done by milking all the best cows, selling the milk or butter, and raising the calves on skimmed milk or other feeds. Another method might be to sell milk or butter from part of the herd by placing two calves on other cows in the herd not milked. By such practice the credits would be greatly increased and the cost of production correspondingly reduced.

Calf credits can be increased by methods that would insure a greater calf crop. This can be obtained by proper selection of the breeding females. Eliminate all barren and shy-breeding cows and retain only the best heifers after they have proved their worth as breeding females.

Regardless of the breeding qualities of the females, the percentage calf crop will be decreased when there are more cows in the herd than the bull can serve.

IMPROVING THE BREEDING HERD.

Generally speaking, the breeding herd in the Corn Belt, as adapted to commercial beef production, is composed of grade cows and a purebred bull of good individuality. In many cases the cows are purebred, but without registration papers. Purebred animals of excellent individuality, but having certain defects in breed type such as to render them less desirable for the show ring or for purebred breeding purposes, can often be obtained at but little more than market prices. These animals make excellent foundation stock for a commercial

beef herd. Each generation in the breeding herd should be a marked improvement over the preceding one. The best way to get this result is by the use of good registered bulls and proper selection of females. The value of a registration paper in the case of bulls, even in the grade herd, is twofold—a registered bull will usually bring considerably more money, and his breeding is definitely known. Bulls called purebreds and eligible to registry, and bulls from so-called purebred herds where registration papers are not kept up, are usually questionable unless one knows the conditions under which the animals were produced.

Purebred bulls of good individuality generally transmit to their offspring the qualities most desired in the beef animal. Their ancestors have been bred to conform to a well-defined type. Grade bulls are undesirable because their ancestors have not been bred to conform to a well-defined type.

All registered bulls are not suitable to head a grade herd, because many are undesirable individuals. Individuality in the bull should have first consideration. Improving the breeding by careful selection of the female stock and breeding to good bulls will result in more money for the offspring.

ECONOMICAL FEEDING OF THE BREEDING HERD.

Details of feeding the breeding herd are not given here because this subject is fully discussed in other publications. Economical feeding of the herd, however, will often mean profit in the production of the calf when careless, wasteful practices would mean a decided loss. There is a tendency on the part of some Corn Belt feeders to feed too much high-priced feed, and again others starve their breeding animals during the winter.

During the summer months good pasture is the one essential feed as well as the most economical. Additional feed is not necessary when the breeding herd is kept on good pasture, but as the carrying capacity of pastures decreases in the fall, additional feed should be supplied. Stovers, fodders, and hays are economical supplemental feeds for the late-pasture season. Cornstalk fields should be utilized a little later and during the early winter.

The breeding herd should be kept in thrifty condition all winter. Each cow must have sufficient feed for her own maintenance and, in addition, feed to supply the developing fetus she is carrying. Young stock should not lose in weight during the winter months. Bulls should go through the winter and come out in the spring in a vigorous condition.

Feeds for wintering the breeding herd need not be expensive. Roughages should be utilized to the utmost, with a minimum of

grain and protein concentrates. Roughages commonly used in the Corn Belt are silage, corn and sorghum fodder, stover, straw, and hay.

There is no feed that will carry the breeding herd through the winter so economically as silage, which, however, should be supplemented with some dry roughage and protein concentrate. If the dry roughage consists of a legume hay, such as clover or alfalfa, the addition of a protein concentrate is not essential, as the necessary protein is supplied by the hay.

When oats or wheat straw make up the dry roughage it is advisable to supply some protein concentrate, such as cottonseed or lin-

FIG. 2.—A breeding herd on pasture in southwestern Iowa. In the Corn Belt good pasture alone will furnish the necessary feed for the breeding herd throughout the summer and early fall.

seed meal or cake. A very small amount of the concentrate will suffice.

Where silage is not available, corn or sorghum fodder, stover, straw, or hay should make up the bulk of the winter ration. The breeding herd can be kept in condition on good-quality legume hay alone. However, when legume hay is very high in price this may not be an economical feed. If part of the hay is replaced by good straw, fodder, or shredded stover the ration can be materially cheapened. Under some conditions it might be more economical to sell part of the legume hay and substitute for it the cheaper roughages with some highly concentrated protein feed. Relative prices should determine this fact.

WINTER RATIONS FOR THE BREEDING HERD.

The following winter rations for the breeding herd are suggested:

Rations with silage.

Ration 1:	Pounds.
Silage	30
Straw	10
Cottonseed or linseed meal	1
Ration 2:	
Silage	25
Clover or alfalfa hay	10
Ration 3:	
Silage	35
Mixed hay	10
Cottonseed or linseed meal	½

Rations without silage.

Ration 4:	Pounds.
Corn fodder	15
Oat straw	10
Cottonseed or linseed meal	1
Ration 5:	
Clover or alfalfa hay	20
Straw or stover	5
Ration 6:	
Mixed hay	10
Mixture of corn, bran, and oats—equal parts by measure	5
Straw or stover	10

WINTER RATIONS FOR STOCKERS.

Stockers or feeders can be wintered largely on such roughages as silage, stovers, hays, and straws. The following rations are suggested for wintering stocker calves.

Ration 1:	Pounds.
Silage	15
Clover or alfalfa hay	4
Ration 2:	
Silage	15
Cottonseed or linseed meal	½
Straw or stover	5
Ration 3:	
Alfalfa or clover hay	10
Straw or stover	5
Ration 4:	
Mixed hay	10
Straw or stover	5
Cottonseed or linseed meal	1

For stocker yearlings these rations should be increased about one-half.

II. BUYING FEEDERS FOR THE CORN BELT.

Buying and selling ability plays as important a part as skillful feeding in the successful handling of feeder cattle. Successful feeders study market conditions. In some seasons certain weights and classes of cattle may be purchased more economically than others. The cattle feeder should study the demands of the market for certain seasons and feed the kind of cattle that will be in demand when they are ready for market.

Ordinarily, early-fall buying is preferable, as competition between packers and feeders usually increases as winter approaches. Cattle intended for fattening on grass the following summer should be purchased in the fall if there is an abundant supply of cheap roughages on hand.

The bulk of feeders are purchased during the fall at Kansas City, Omaha, Chicago, East St. Louis, and St. Paul. Buyers usually get their feeders at the market closest to them.

MARKETS SUPPLYING FEEDERS.

The following table shows the total receipts of cattle during 1920 at the markets which furnish the bulk of feeders for the Corn Belt, the total number of cattle that are reshipped as feeders, and the percentage of the total receipts that are feeders.[3]

TABLE 2.—*Receipts, shipments, and percentage of feeders at nine largest markets.*

Market.	Total receipts of cattle.	Shipments of feeding cattle.	
	Number.	*Number.*	*Per cent.*
Kansas City	2,500,166	778,214	31
Omaha	1,602,799	450,647	28
Denver	616,565	407,026	66
Chicago	3,849,495	386,199	10
St. Paul	1,373,114	315,977	23
Sioux City	751,658	238,271	31
East St. Louis	1,253,550	167,797	13
St. Joseph	642,899	102,964	16
Indianapolis	597,097	47,705	8

More feeders are redistributed from Kansas City to points in the Corn Belt than from any other market. Omaha stands second in importance. Denver is third in shipments of feeder cattle, but does not supply directly to the Corn Belt so many feeders as either Chicago or St. Paul, since many of the feeder shipments to Denver are reshipped to Kansas City and Omaha.

THE QUALITY OF FEEDERS.

The higher the grade or quality of the feeder the more economical will be its use of feed. The high-grade steer will not eat less feed; in fact, he will have greater capacity, but will make more economical use of it in the way of laying on flesh in the regions of the valuable cuts. The buyer should keep this fact in mind, but not be influenced to such a degree as always to buy the highest-priced feeders.

Fleshy feeders usually cost more money and are not so popular for feed-lot purposes as thin feeders. On extremely short feeds and when prospects are good for higher prices, however, they can often be used to advantage.

AGE OF FEEDERS.

The quantity and nature of available feeds and the length of feeding period are the factors which largely should determine the age of cattle to feed. The younger the animals the longer will be the feeding period. Young cattle put their feed to three distinct uses: First, maintenance; second, growth; and third, fat. All animals require a certain amount for maintenance, but the amount required for

[3] Figures compiled by Bureau of Markets, U. S. Department of Agriculture.

growth diminishes gradually with the age of the animal. As growth ceases, more of the feed above that required for maintenance goes toward fat formation. Older cattle, therefore, fatten in a much shorter time. Mature feeders fatten in 3 or 4 months, 2-year-olds in 5 to 7 months, yearlings in 8 to 10 months, and calves in 10 to 12 months.

The kind and quantity of feed must be considered in determining the age of cattle to feed. An abundance of feed makes possible a long feeding period and the feeding of younger cattle to advantage. Older cattle use roughages more advantageously, but in general young animals make more economical use of all feeds. In other

FIG. 3.—Cornstalk fields can be utilized to best advantage by stocker cattle and the breeding herd.

words, the older cattle make greater daily gains, but not so economically.

Mature cattle require from 9 to 11 pounds of digestible nutrients, depending upon the feeds used in the ration, to make a pound of gain, whereas yearlings require 6 to 8 pounds, and calves only 4 to 6 pounds. The Kansas Experiment Station reports (Circular 77) that in its investigation of winter feeding in 1918–1919, 2-year-old steers required 33 per cent more corn, 36 per cent more concentrates (linseed meal), and 21 per cent more silage than baby beeves to produce 100 pounds of gain.

Uniformity is more certain with the older cattle. Three or four months' difference in age means considerable difference in size with young cattle, but relatively little with the older ones. Older cattle also usually show more uniformity in finish.

III. FATTENING STEERS IN THE CORN BELT.

Feeding cattle for market is simply one method of marketing the crops. On 287 farms in the Corn Belt an average of 35 per cent of the 1919 crops was fed to cattle.[4] The feed crops are transformed into beef and put on the market in that form. The real object in feeding a crop is to return a reasonable profit above the cost of production and at the same time maintain the soil fertility.

The fattening of cattle throughout the Corn Belt area is of two types—dry-lot fattening and fattening on grass. Fully 90 per cent

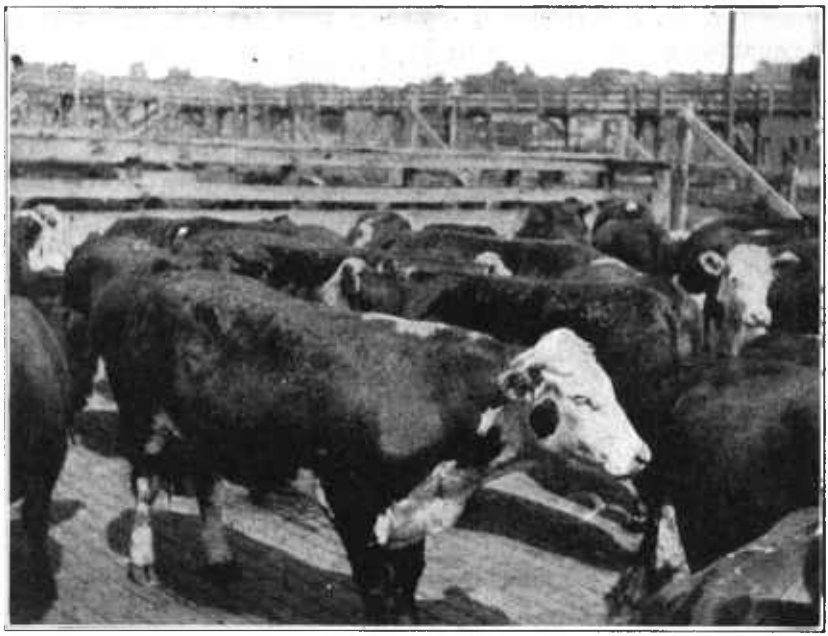

FIG. 4.—Fleshy feeders on the Omaha market. Cattle in this condition can be finished on a good ration in a very short feeding period.

of the fattened cattle in this area are dry-lot fed and are marketed before July first. Very few cattle fed heavily on grain during the winter and spring months are ever put on green grass.

In some sections of Missouri feeders purchased in the fall are "roughed" through the winter largely on cornstalk fields, straws, hays, stover, and silage. In the spring the cattle are turned on to grass and fed a half-grain ration. Cattle handled in this way usually are marketed before September first.

[4] This item, and the data in Tables 4, 5, 6, 8, 9, and 10 are compiled from surveys taken in cooperation with the Office of Farm Management and Farm Economics and State agricultural colleges.

GETTING STEERS ON FULL FEED.

Starting steers on feed requires careful management. Gradual increases in the quantities of feed in the ration, as determined by careful observation, are essential to success in getting steers up to full eating capacity. The time required depends primarily upon the length of feeding period and is influenced by the age of the cattle. The feeding period for 2-year-olds varies from 5 to 7 months, with an average, in the Corn Belt, of about 175 days. Older cattle fatten in a shorter period; younger cattle require a still longer period. As an illustration, when 2-year-old cattle are to be fed a corn-and-clover ration for a 6-months' period a good practice is to increase the quantities of feed gradually so that the cattle will be on full feed

FIG. 5.—Long yearling feeders, representative of the average feeders, going into the Corn Belt feed lot.

in not less than 30 days. They can be handled safely as follows: Start with 2 pounds of corn a day and increase 1 pound a day until 10 pounds is reached. Hold at this point for four days. Then increase 1 pound every three days until 20 pounds is reached, which will be in about 40 days. The steers can receive all the roughage they are able to consume from the beginning without any ill effects.

When protein concentrates are used in the fattening ration, increases should be even more gradual than with corn. A conservative amount of cottonseed or linseed meal to start cattle on would be half a pound.

In a general way all concentrates should be gradually increased as the feeding period advances and the roughages should be decreased.

METHODS OF DRY-LOT FEEDING.

Dry-lot feeding methods are in a broad sense similar throughout the Corn Belt. In some States more grain is used in the rations, in others more concentrates, and in still others a more efficient use is made of roughages. All dry feeding is divided into two classes, those in which silage is fed and those in which silage is not fed. There is as a whole nearly an equal division of these two classes, although in some States the difference is very marked.

Surveys on feeding during the winters of 1918–19 and 1919–20 showed that 83 per cent of 4,556 cattle fed in Indiana received silage

FIG. 6.—A uniform drove of Hereford steers feeding on a silage ration in northeastern Kansas.

in their rations; 87 per cent of 7,280 in Illinois; 30 per cent of 8,290 in Iowa; 8 per cent of 6,129 in Nebraska; and 50 per cent of 8,964 in Missouri.

ROUGHAGES USED IN DRY-LOT FEEDING.

SILAGE.

Where silage is used it supplies the bulk of the roughage. Corn is the crop most generally used for silage and perhaps furnishes as much as 99 per cent of the total silage fed. In this bulletin the term silage means corn silage. Sorghum, sunflowers, and legumes are sometimes used in those localities which are on the extreme edge of the Corn Belt, such as western Kansas and Nebraska and western

and northern South Dakota. In the past, silage has been considered a very cheap feed, but the price of corn the last few years and the high cost of labor have increased its cost, although proportionately no more than that of other feeds.

A greater use of silage depends largely upon the supply and value of other roughage. Ordinarily, an abundance of cheap roughage lessens the use of silage. When roughage is scarce and high priced, silage should be used more extensively.

Generally speaking, the value of silage in fattening steers depends upon the amount of corn required where silage is used, as compared with the amount of corn used where silage is not used in the ration. This will be influenced somewhat by the price of concentrates, as an additional quantity of concentrates is usually required when corn is decreased in the ration. When the corn is of good marketable quality and high priced, it is ordinarily good policy to limit the corn ration and to supply more protein concentrates along with silage.

The Purdue University Agricultural Experiment Station reports (Bulletins 220, 240, and 249) the results of experiments carried on for three years, 1917 to 1920, comparing rations containing different amounts of corn and no corn for fattening steers. The results are shown in Table 3.

TABLE 3.—*Comparative results of three years' feeding, with varying amounts of corn in the ration.*

Item.	All lots fed basic ration of cottonseed meal, corn silage, and clover hay.			
	Lot I. Shelled corn (last 53 days).[1]	Lot II. No corn.	Lot III. Shelled corn, one-half feed.	Lot IV. Shelled corn, medium to full feed.[2]
Average length of feeding period.....days..	137	137	137	137
Average daily gain.....pounds..	1.96	1.80	2.07	2.26
Daily ration per steer:				
Shelled corn.....pounds..	4.95	.....	6.09	12.04
Cottonseed meal.....do....	2.71	2.70	2.74	2.75
Corn silage.....do....	43.91	50.69	43.85	33.11
Clover hay.....do....	4.39	4.78	4.30	4.12
Feed consumed per pound of gain:				
Shelled corn.....do....	2.52	.....	2.96	5.38
Cottonseed meal.....do....	1.40	1.53	1.34	1.23
Corn silage.....do....	22.72	28.49	21.48	14.73
Clover hay.....do....	2.27	2.70	2.11	1.83

[1] Lot I was fed approximately 14 pounds corn daily per steer for last 40 days 1917-1918; 13.5 pounds for last 60 days 1918–1919; and 12.27 pounds for last 60 days 1919–1920, or on a 3-year average, 13.26 pounds daily per steer for 53 days, or 4.95 pounds daily for 137 days (average feeding period for 3 years).

[2] Lot IV received a medium feed of shelled corn daily per steer (10.73 pounds) during 1917–1918, and full feed (12.54 and 12.84 pounds daily) for 1918–1919 and 1919–1920.

A full feed of corn materially increased the daily gains over a limited feed of corn, or no corn, but this increase was not in direct proportion to the amount of corn added.

The silage consumption was greatly reduced by the addition of corn. This decrease was directly proportional to the amount of

corn added. The cattle receiving the most corn consumed only 33.11 pounds of silage as compared with 50.69 pounds when no corn was fed.

The figures in Table 3 are valuable because they are based on averages of 3 years' work on the same experiment with the same number of cattle. The results each year were relatively the same; that is, the lots kept in the same relative positions from year to year. This makes the average of the 3 years' work all the more reliable.

Such data as are given in this table are of use from year to year because the relative quantities of feed required to make a pound of gain should hold true indefinitely. Prices of feeds, however, will

FIG. 7.—Steers of good quality on feed in northeastern Kansas. Note the natural windbreak in the background, the substantial construction of the feed bunks, and the inexpensive but satisfactory rack for hay and other roughage.

influence these rations from time to time by making one combination more profitable one year than another. Prevailing prices of the feeds each year can be applied to the quantity in the daily ration or the quantity required to make a pound of gain, and the most economical ration can readily be determined.

The Kansas Agricultural Experiment Station demonstrated the value of sorghum silage with different amounts of ground corn in a feeding test of 120 days, beginning January 15, 1919. The results were very similar to those of the Indiana work.

The main facts about the use of silage in the winter fattening of cattle may be summarized as follows:

Under average conditions the greater the proportion of silage to corn in a fattening cattle ration the more economical the gains.

The greater the quantity of corn in a ration the less the silage consumption.

Economy of gains depends largely upon the quantity of roughages the cattle will eat.

Silage by itself is not a fattening feed; it must be supplemented with other feeds, especially a protein concentrate, such as cottonseed meal or linseed meal, or with a legume hay, such as clover or alfalfa.

The use of silage guards against waste of roughage, as a large proportion of the cornstalk is wasted when fed in any other form.

The use of silage makes possible a greater saving of high-priced hays and a more efficient use of straws and stovers. Cattle on full feed of silage consume more straw or stover than when on full feed of legume hay.

The use of silage when it involves the purchase of protein concentrates adds to the value of the manure, which is an asset to most farms.

Silage-fed cattle do not usually have the finish found on strictly dry-fed cattle.

Silage supplemented with corn insures a more uniformly finished animal, which usually brings more money; and this feed also insures greater gains on hogs following the cattle.

Shrinkage is greater with silage-fed cattle than with strictly dry-fed cattle.

The price of corn and the value of other concentrates should be a guide as to the limit of corn in a silage ration.

ALFALFA AND CLOVER HAY.

Alfalfa and clover hay, because of their high-protein contents, are the dry roughages that are by far the most popular with cattle feeders. Commercial concentrates need not be supplied to the fattening ration if liberal amounts of these hays are given. In some sections of the Corn Belt, however, roughages can be supplied more economically by using stovers, fodders, or straws, and protein can be supplied more cheaply in concentrates than in roughages. In other sections, as in Nebraska, where large crops of alfalfa are produced, and at considerable distance from railway shipping stations, it is seldom necessary or advisable to purchase commercial concentrates as a source of protein.

Clover has practically the same feeding value as alfalfa in a ration for fattening beef cattle. The same quantity of hay in each case should give nearly equal results.

The Purdue Agricultural Experiment Station reports (Bulletin 245) the results of a comparison of clover hay with alfalfa hay in a ration with corn, cottonseed meal, and corn silage, when fed to fat-

tening cattle. Eight years of experimental work, in which cattle were fed rations similar in every way except that half the steers received alfalfa hay and the other half clover hay, has proved that these hays have practically the same feeding value. The quality of the hay had more influence on its feeding value than the kind of legume from which it was made.

Clover or alfalfa should by all means be grown in the rotation on all Corn Belt farms, but its use in the beef-cattle-fattening ration must be governed by the quantity of other roughages on the farm and the relative prices of protein in legume hay and the protein concentrates. Generally speaking, where the supply of home-grown

FIG. 8.—Clover field in northwestern Iowa. Clover plays an important part in the rotation in this section, and is consumed largely by beef cattle.

legume hay is ample, its use in the ration is preferable to the use of concentrate, for used as a source of roughage and fed in reasonable amounts it will supply also the necessary amount of protein to fattening cattle.

The Nebraska Agricultural Experiment Station reports (Bulletin 174) a comparison of corn and alfalfa hay with corn, alfalfa hay, and cottonseed cake, when fed to 2-year-old steers for 130 days. A ration of 18.12 pounds of corn and 11.75 pounds of alfalfa hay produced a daily gain of 2.77 pounds as compared with 2.56 pounds of daily gain with a ration of 16.56 pounds of corn, 1.71 pounds of cottonseed cake, and 11.51 pounds of alfalfa.

Experimental work extending through a series of years at the Nebraska station has tended to show that a corn-and-alfalfa ration produced as economical gains as any ration used. There was no advantage in the addition of a protein concentrate to a corn-and-alfalfa ration. The cattle fed corn and alfalfa alone made a fifth of a pound greater daily gains on practically the same total feed as those receiving cake in addition. The addition of the protein concentrate to the corn-and-alfalfa ration did not increase the finish of the animals.

GRASS HAYS.

Grass hays, with the exception of timothy, are produced in such small quantities in the strictly Corn Belt area that they are not considered hays of much importance in fattening cattle in that area. These hays can generally be utilized more advantageously with horses or in wintering other classes of stock.

Timothy is usually grown with some variety of clover, making a mixed hay which is very popular with cattle feeders in some sections of the Corn Belt.

STOVER, FODDER, AND STRAW.

The use of stovers and straws in beef-cattle rations has a direct bearing upon the economy of gains. All roughage of this nature produced on the farm should be used on the farm. A wintering ration for stockers and feeders can be made up largely of these cheaper roughages. With the fattening animal a certain amount can be advantageously used when supplemented with concentrates and other roughage. In the fattening ration this class of roughage has its greatest usefulness when fed along with the silage.

A certain amount of dry roughage is beneficial in a silage ration. This can be supplied most economically by stovers or good straw. Stover is the stalk and leaves of a plant and does not include the grain or seed. The term "stover" is generally applied to the corn plant, but in the extreme western part of the Corn Belt sorghum stover is of equal or more importance.

Fodder is the stover plus the grain; in other words, the whole plant. A large part of the corn crop in the eastern area of the Corn Belt is cut up as fodder and shocked, but very little is used in that form in the fattening ration. The corn is husked out during the winter and the remaining stover fed as roughage. A shredder is a valuable piece of machinery in this connection. It will take the corn from the stover and tear the stover into small pieces, the greater portion of which will be relished by livestock. Unless the stover is shredded, there is considerable waste in feeding it. Many of the smaller leaves are lost in handling and very little of the coarse stalk is eaten.

Corn fodder is valuable in getting range steers accustomed to eating grain. Cattle that have never seen anything but grass and hay are slow to begin eating corn. If given corn fodder they will eat the leaves and gradually get hold of the corn and eat it.

The cereal straws are valuable as a source of roughage in all sections of the Corn Belt. Oat straw is the most valuable as a feed. Barley straw, while superior to wheat straw in feeding value, is not produced in sufficient quantity to be as important a roughage as wheat straw.

Straws should not be wasted by burning. Good, bright straw should be kept before beef cattle during the winter months. It is relished more during the cold weather. Cattle do not eat much straw in warm weather if they have access to other feed. The experienced feeder or farmer necessarily utilizes as much good straw as possible during the coldest weather. The poorest straw, so long as it is dry, should be utilized as bedding. The cattle should have an oversupply of bedding rather than too little, as the manure produced is always worth more than the cost involved in handling the bedding and in applying the manure to the land.

Table 4 shows the distribution, by States, of roughages in cattle feeding as obtained by surveys in the Corn Belt.

TABLE 4.—*Percentage of the various roughages used in cattle feeding in Corn Belt States.*

Roughage.	Indiana.	Illinois.	Iowa.	Nebraska.	Missouri.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Silage	84	71.6	58	20	79
Clover hay	1.7	4	13	7	0.9
Alfalfa hay	0.3	1	10	49.5	5
Timothy hay	.....	0.2	1.2	.....	0.1
Mixed hay	5.1	7	3	7	3
Wild hay	.....	.....	0.3	10	.....
Corn stover	0.8	0.2	4.5	0.5	6
Straw	8.1	16	10	6	6
Total	100	100	100	100	100

A study of Table 4 reveals the fact that considerable variation exists in the different States listed. Where silage makes up the bulk of the roughage, as is the case in Indiana, Illinois, and Missouri, there is a greater use of the cheaper roughages, such as straw and stover. In Nebraska, however, silage constitutes only 20 per cent of the roughage, while alfalfa hay supplies about 50 per cent. This substantiates previous statements that a larger amount of cheaper roughages can be utilized more advantageously where silage, rather than a legume hay, forms the bulk of roughage.

Timothy and wild hay are used in only negligible quantities in any section of the Corn Belt, except that in Nebraska wild hay makes

up 10 per cent of the roughage. Mixed hay (clover and timothy) is used more or less in the central part.

CONCENTRATES USED IN DRY-LOT FEEDING.

The concentrates used in fattening beef cattle in the Corn Belt may be divided into three classes—protein concentrates, carbohydrate concentrates, and mixed concentrates.

The protein concentrates are those used primarily to supply protein to the ration; the carbohydrate concentrates, those supplying the carbohydrates and fats; and the mixed, those that supply both protein and carbohydrates in an intermediate proportion. The most popular protein concentrates in the Corn Belt are cottonseed meal and cake and linseed meal. Corn, oats, and barley are the carbohydrate concentrates most used. To the third class, mixed concentrates, belong most of the proprietary feeds made up largely of cereals, meals, alfalfa, protein concentrates, and molasses.

PROTEIN CONCENTRATES.

Protein concentrates in some form are used quite generally throughout the Corn Belt, especially in sections that do not produce a sufficient supply of clover or alfalfa hay to supply the necessary protein in the ration. Supplying protein is of more concern to the cattle feeder than supplying the other constituents of the ration because of the fact that the protein constituent usually has to be purchased. Cottonseed meal or cake usually supplies the cheapest protein in a concentrated form. Many grades of cottonseed products are on the market. It is quite essential that the purchaser examine the analysis and purchase the grade that will supply protein most cheaply. For example, cottonseed meal running 40 per cent protein and valued at $60 a ton would be preferable to meal with 36 per cent protein and priced at $55 a ton. A ton of meal containing 40 per cent protein has 800 pounds of protein and if valued at $60 a ton the protein would cost 7.5 cents a pound. A ton of meal containing 36 per cent protein has 720 pounds of protein; and at $55 a ton for the meal the protein would cost 7.6 cents a pound. The 36 per cent meal at $54 a ton would supply protein at the same price as 40 per cent meal at $60 a ton. The figures set forth in the following table should be a guide in determining the cheapest source of protein at various prices of feed.

Cottonseed meal, while it is used more extensively throughout the Corn Belt as a whole, is no more popular than linseed meal. Most cattle feeders actually prefer linseed meal, but owing to its somewhat higher market value it is not used so extensively.

TABLE 5.—*Cost of one pound of crude protein in feeds most commonly used as a source of protein in Corn Belt feeding.*

Price of feed per ton.	Cost per pound of crude protein.[1]				
	Clover hay.	Alfalfa hay.	Wheat bran.	Linseed meal.	Prime cotton-seed meal.[2]
Dollars.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
5.00	1.79	1.56	.....	.....	.....
7.50	2.68	2.34	.....	.....	.....
10.00	3.57	3.12	.....	.....	.....
12.50	4.47	3.90	.....	.....	.....
15.00	5.36	4.69	4.69	.....	.....
17.50	6.25	5.46	5.46	.....	.....
20.00	7.14	6.25	6.25	2.86	2.56
22.50	8.04	7.02	7.02	3.21	2.88
25.00	8.93	7.81	7.81	3.57	3.20
27.50	9.83	8.59	8.59	3.92	3.52
30.00	10.71	9.37	9.37	4.28	3.85
35.00	12.50	10.94	10.94	5.00	4.49
40.00	14.29	12.50	12.50	5.71	5.13
45.00	.....	14.06	14.06	6.43	5.77
50.00	.....	15.62	15.62	7.14	6.41
55.00	.....	.....	17.19	7.86	7.05
60.00	.....	.....	18.75	8.57	7.69
65.00	.....	.....	.....	9.28	8.33
70.00	.....	.....	.....	10.00	8.97

[1] The feeds contain crude protein approximately as follows: Clover hay, 14 per cent; alfalfa hay and wheat bran, 16 per cent; linseed meal, 35 per cent; and prime cottonseed meal, 39 per cent.

[2] Cottonseed meal is sold in 3 grades—choice, containing at least 41 per cent protein; prime, with at least 38.6 per cent protein; and good, containing al least 36 per cent protein. Meal falling below 36 per cent protein is classed as cottonseed feed. The prime grade is used most extensively.

Linseed meal is more laxative than cottonseed meal; hence it has a more beneficial effect on the digestive system of the animal. It contains a lower percentage of protein, yet the protein is more digestible, so that there is very little difference in the amount of protein utilized by the fattening animal from the same number of pounds of cottonseed and linseed meal. Linseed meal puts a more glossy coat on the animal, which usually gives the appearance of more finish.

Hogs following cattle fed linseed meal do much better than those that follow cattle fed cottonseed products.

MIXED CONCENTRATES.

Molasses feed and other miscellaneous concentrates are in much demand in some sections of the Corn Belt. They are usually priced considerably under cottonseed products or linseed meal, but do not supply protein so cheaply as the meals just mentioned nor carbohydrates so cheaply as can be supplied in the home-grown feeds.

Molasses in combination with other feeds makes a feed that is very palatable to cattle. The blackstrap molasses can usually be bought at a price that justifies the farmer in buying it by itself and mixing it with the feed grown on the farm.

Table 6, based on the survey work already referred to, shows that cottonseed meal is the protein concentrate used most in the States of

Illinois, Indiana, and Missouri. Linseed meal is used most in Nebraska, but owing to the ample supply of alfalfa hay grown on most farms, it is of relatively minor importance. In Illinois, cottonseed meal and linseed meal constitute the bulk of concentrates in nearly equal proportion. In Iowa the records indicate the use of molasses feed to be as general as cottonseed and linseed meal combined.

FIG. 9.—A very satisfactory feed lot for the southern area of the Corn Belt. Feed bunks are well made. The straw stack, used as a windbreak, is very satisfactory in all but stormy weather. The steers shown are of good quality, being dehorned, smooth, and good grade. The hogs following the cattle will utilize the waste feed. This is a factor of much importance in steer feeding as the profit in a feeding operation is often determined by the pork credit.

TABLE 6.—*Percentage of different concentrates used in Corn Belt States.*

Feed.	Indiana.	Illinois.	Iowa.	Nebraska.	Missouri.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Cottonseed meal	54	55	18	0.5	46
Linseed meal	2	45	24	80	15
Molasses feed	28	.....	49	14	24
Miscellaneous concentrates	16	.....	9	5.5	15
Total	100	100	100	100	100

CARBOHYDRATE CONCENTRATES.

The carbohydrate concentrates in the Corn Belt consist of about 90 per cent of corn in some form. Oats are frequently used in the latter part of the feeding period, principally to put the cattle in better shipping condition. Barley is used only in a small way as a fattening cattle feed, although in Illinois barley made up 10 per cent of the grain ration, according to surveys taken in 1918–1919, involving the feeding of 2,668 cattle.

Table 7 shows the percentage each concentrate is of the total. This table and Tables 4 and 6 are based on surveys taken in the county or counties doing the most cattle feeding. Other sections of the State will vary somewhat, but in a general way these percentages should be fairly representative of the true feeding conditions of the State.

This table shows on a general average of the entire Corn Belt that ear corn is the most popular form in which corn is fed. In only one of the five States under consideration was ear corn second in percentage, namely, in Iowa, where shelled corn appears to have the preference.

TABLE 7.—*Percentage of different carbohydrate concentrates used in Corn Belt States.*

Feed.	Indiana.	Illinois.	Iowa.	Nebraska.	Missouri.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Ear corn	39	37	26	32	78
Shelled corn	16	20	59	28	8.4
Corn-and-cob meal	32	5	4	1	.....
Ground shelled corn	2.5	10	3	3	.....
Crushed ear corn	3	9	.....	13	1.3
Ear and shelled corn	.....	2	1	13	0.8
Oats	7	7	4	10	11.5
Barley	0.5	10	3	.....	.....
Total	100	100	100	100	100

FEED REQUIRED FOR 100 POUNDS OF GAIN.

The feed requirements for 100 pounds of gain naturally vary according to the age, quality, and condition of animal and according to the nature and quantity of the feed.

The average weight of cattle at the time of going into the feed lot throughout the Corn Belt is between 750 and 800 pounds. The actual average per animal of 34,934 cattle included in the survey work heretofore referred to was 786 pounds. This would indicate that the average feeder going into the feed lot is a long yearling about 18 to 20 months of age. Tables 4 to 7 indicate in a general way the feeds used and the percentage of each. Table 8, below, indicates the feed consumed per 100 pounds of gain on 341 droves numbering 13,970 cattle fed throughout Indiana, Illinois, Iowa, Nebraska, and Missouri during the winter of 1918 and 1919. Approximately 50 per cent of the cattle were fed silage.

TABLE 8.—*Approximate quantity of feed consumed per 100 pounds of gain by Corn Belt cattle fed with and without silage.*

Feed.	With silage.	Without silage.	Average.
	Pounds.	*Pounds.*	*Pounds.*
Grain	450	700	575
Hay	250	350	300
Concentrates	100	50	75
Stover	30	90	60
Straw	130	50	90
Silage	1,630	.....	815

The feed consumed for 100 pounds of gain on 34,934 head of cattle fed the last two years—1918–19 and 1919–20—is shown in Table 9. No division is made between those fed silage and those not fed silage.

The initial and final weights of the cattle are absolutely correct, being taken direct from bills of sale. The total amounts of feed consumed were derived from survey records, in some cases the actual figures, and from farmers' estimates in others. Only records were used where the farmers had a good knowledge of what feed the cattle actually consumed.

Under these conditions, and considering the large number of cattle involved, the figures set forth in Table 9 should be quite accurate.

TABLE 9.—*Feed consumed per animal and per 100 pounds of gain in Corn Belt States.*

Item.	Indiana.	Illinois.	Iowa.	Nebraska.	Missouri.	Average for Corn Belt.
Number of cattle	4,577	7,306	8,290	6,104	8,657	.....
Initial weight per steer.....pounds..	760.1	818.3	787.7	766.0	783.3	786
Final weight per steer.....do....	1,037.8	1,071.0	1,145.1	1,044.5	1,027.9	1,070
Gain per steer.....do....	277.7	252.7	357.4	278.5	246.4	284
Length of feeding period.....days..	184	177	164	153	194	174
Total feed consumed per steer:						
Grain.....pounds..	1,487	1,417	3,437	2,031	1,093	1,932
Commercial concentrates.....do....	222	199	123	39	278	175
Dry roughage.....do....	779	1,265	1,191	1,604	731	1,111
Silage.....do....	4,409	5,559	1,242	315	1,461	2,452
Pasture.....days..	35	31	42	31	114	55
Total feed consumed per 100 pounds gain:						
Grain.....pounds..	517	561	962	730	444	680
Commercial concentrates.....do....	80	79	34	14	113	62
Dry roughage.....do....	280	501	333	576	297	391
Silage.....do....	1,588	2,200	348	113	593	863
Pasture.....days..	13	12	12	11	46	20
Estimated cost of 100 pounds gain at following prices of feed:[1]						
Grain at 60 cents per bushel.....	$5.53	$6.00	$10.29	$7.81	$4.75	$7.28
Commercial concentrates at $36 a ton..	1.44	1.42	.61	.25	2.03	1.12
Roughage at $15 a ton.....	2.10	3.76	2.50	4.32	2.23	2.93
Silage at $4.50 a ton.....	3.57	4.95	.78	.25	1.33	1.94
Pasture at 8 cents a day.....	1.04	.96	.96	.88	3.68	1.60
Total cost.....	13.68	17.09	15.14	13.51	14.02	14.87

[1] Computation made by author.

It may be noted in Table 9 that the items under feed consumed include pasture (days); this is because practically every load of feeder cattle is pastured before going into the feed lot. In many cases the feeders are turned on to cornstalk fields for about 30 days, and at other times they are turned on to blue-grass pastures. The table shows that in Missouri the average steer receives considerably more pasture than is the case in all the other States. This is due partially to a milder climate which allows a longer grazing period in the fall, and to the fact that a great many cattle in Missouri are put into the feed lot toward spring and finished on grass and grain during the summer. The amount of grain in the feed consumed per steer is quite similar in each State, with the exception of Iowa, where considerably more grain was fed. Illinois stands out as feed-

ing the most silage per steer, and Nebraska the least. Nebraska feeds a smaller proportion of concentrates because of the abundance of alfalfa hay grown in that State.

Under the amount of feed consumed for 100 pounds of gain, the figures indicate that the heaviest grain ration produced the greatest total gain per steer.

The average feed per 100 pounds of gain given in the table should be fairly reliable as a unit in determining the cost of 100 pounds of gain in winter feeding. Current prices of feeds applied to the quantities in the table should give a close estimate of the cost of producing 100 pounds of gain on a 2-year-old fattening steer. In applying the current prices the grain may be figured as shelled corn, although there is a small percentage of oats and barley fed;

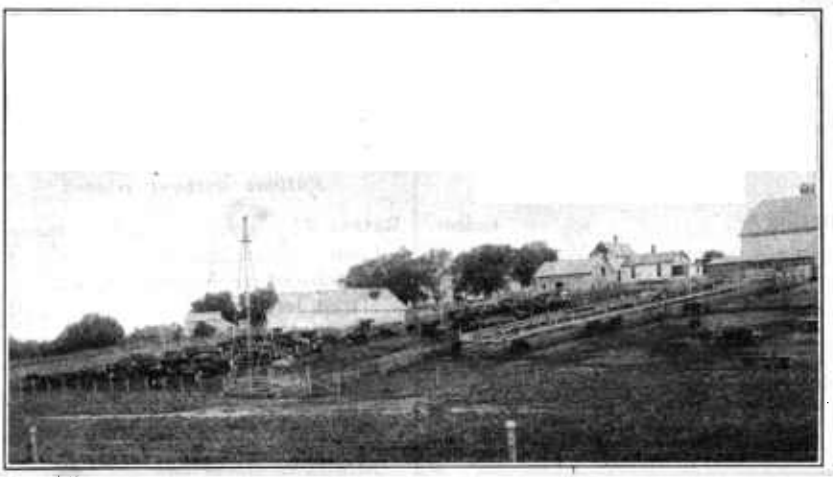

FIG. 10.—A feed-lot scene in eastern Nebraska. Note the natural drainage of feed lots and the convenient arrangement of the lots to corncrib and water supply. The same roughage rack and watering trough can be used by two different lots of cattle.

the commercial concentrates, as cottonseed meal or linseed meal; the roughages, as clover or alfalfa hay; and the pasture, as ordinary blue-grass pasture.

The prices of feed given in the table are merely an estimate of an average price for the winter of 1920–21. It is interesting to note that the Nebraska feeding would result in the cheapest gains at the prices of feed given. The rations used in Nebraska consist chiefly of corn and alfalfa hay with very little supplement. This is a combination of two feeds that is very satisfactory for fattening cattle.

FATTENING RATIONS FOR 2-YEAR-OLD STEERS.

The combination of available feeds that will make the most economical gains is the important factor to consider in compounding

rations. The animal should receive a ration which is balanced or as nearly balanced as is consistent with the practical and logical use of feeds on the farm. An abundance of a certain kind of feed on the farm may make the feeding of a ration which is not perfectly balanced more practicable and economical than the strictly balanced ration. The use of roughages is essential. More or less feed is wasted by overfeeding. With the exception of dry roughages, cattle should not receive more feed at a feeding than they will clean up within an hour. Cattle should always be hungry at feeding time. Water and salt should be before them at all times.

In combining feeds for a ration, the supply of protein should not be overlooked. It should be supplied in the form of either a legume hay or a protein concentrate. Any combination of feeds that does not possess protein from one of these sources is a poor ration for fattening cattle.

The following rations are suggested for fattening 2-year-old steers in the Corn Belt. The quantities stated are for feeders of 1,000 pounds' weight.

Rations with silage.

Ration 1.	Pounds.
Silage	40
Corn	6
Cottonseed or linseed meal	3
Straw or stover	5
Nutritive ratio, 1 : 7.5.	
Ration 2.	
Silage	40
Corn	10
Cottonseed or linseed meal	2
Alfalfa or clover hay	2
Nutritive ratio, 1 : 7.3.	
Ration 3.[6]	
Silage	30
Corn	15
Cottonseed or linseed meal	2
Straw or stover	5
Nutritive ratio 1 : 9.	
Ration 4.	
Silage	20
Corn	18
Alfalfa or clover	6
Nutritive ratio, 1 : 8.7.	

Rations without silage.

Ration 7.[5]	Pounds.
Corn	10
Cottonseed or linseed meal	4
Mixed hay	10
Straw or stover	5
Nutritive ratio, 1 : 5.8.	
Ration 8.	
Corn	10
Cottonseed meal	2
Alfalfa or clover hay	5
Straw or stover	10
Nutritive ratio, 1 : 7.	
Ration 9.	
Corn	16
Cottonseed or linseed meal	2.5
Clover and timothy hay	10
Nutritive ratio, 1 : 6.8.	
Ration 10.	
Corn	20
Alfalfa or clover hay	10
Nutritive ratio, 1 : 7.2.	

[5] A ration like No. 7 would be desirable on a short feed, when protein concentrates are cheap.

[6] Such a ration as No. 3 would be desirable when corn and roughage are plentiful and protein concentrates high priced.

Rations with silage.

Ration 5.	Pounds.
Silage	40
Corn	15
Cottonseed or linseed meal	2.5
Straw or stover	4
Nutritive ratio, 1 : 8.1.	
Ration 6.	
Silage	30
Corn	10
Cottonseed or linseed meal	3
Molasses	2
Straw or stover	5
Nutritive ratio, 1 : 8.	

Rations without silage.

Ration 11.	Pounds.
Corn	15
Cottonseed or linseed meal	3
Straw	5
Stover	10
Nutritive ratio, 1 : 7.8.	
Ration 12.	
Corn	15
Cottonseed or linseed meal	2
Molasses	2
Legume hay	4
Nutritive ratio, 1 : 7.3.	

OPERATING EXPENSES IN FATTENING CATTLE.

In fattening a steer the combined operating expenses usually more than equal the original purchase price of the feeder. The factors considered in operating expense are feed, labor, building and equipment, interest, marketing, insurance, and taxes.

Feed usually constitutes about 80 per cent of the operating expense, so that the other factors combined make up only about 20 per cent. All items of expense other than feed are usually balanced by the manure and pork credits. The different feeds have been discussed, but it should be remembered that this item of expense depends not only on the kind and quantity of the feeds used but also on the way they are combined and fed in the ration.

Labor can be reduced only by having labor-saving devices and by having a convenient arrangement of equipment, so that the actual feeding operation will take as little time as possible. Feed bunks conveniently arranged, feed carriers from silo or cribs to the bunks, and all roughage and bedding placed in a shed convenient to the other equipment are factors which should influence this labor charge. If things are handy around the feed lot, one man can care for a large number of cattle in a very short time.

Buildings and other equipment are important factors in the operating expense of fattening cattle. It is only just that cattle should be charged for the equipment they use. Interest, depreciation, and upkeep charges on that portion of equipment used by the cattle should be charged to them.

Unusually expensive buildings and equipment devoted exclusively to fattening cattle might mean the difference between loss and profit on a bunch of steers. It is not necessary to have extra good barns for steer feeding alone. In most sections of the Corn Belt a shed having an open side or end is all that is necessary for shelter. If cattle are kept dry and have protection from the winds and storms

by having access to a shed they will do very well, other factors being equal. It is advisable to have all feed under cover. A shed having space for hay and for straw for both feed and bedding in the center, or on one side, and permitting the cattle to eat these roughages under shed and have a place to lie down in cold weather, is very desirable.

Interest, while important, can not be changed much by the cattle feeder. It is usually figured only on the purchase price of the cattle.

Insurance actually carried on fattening cattle in reality amounts to very little. The items of death risk and veterinary charges are considered as coming under insurance. Where the farmer does not pay an insurance company a premium covering cattle losses, it can be

FIG. 11.—Hereford steers in an Iowa feed lot. The open shed for protection against stormy weather is very popular with the Iowa cattle feeder.

said justly that the farmer carries his own insurance. In the event that the cattle feeder loses an animal his insurance has cost him the value of that loss.

When an animal dies while on feed, each remaining animal in the lot must carry its proportionate share of the loss. This is known as the death risk. Veterinary charges may also be considered as insurance, as they are expended for the protection of the animal against disease or death.

Marketing, or cost of getting the animal to market, depends largely upon the distance from market, as the freight charge is usually the largest item of expense. Other items of expense, such as bedding and loading, feed in transit and in yards, yardage, terminal charge,

commission, and expenses of the person accompanying the cattle to market, are included in the cost of marketing.

In connection with the freight charge it is important that the car be loaded to at least minimum capacity, as the freight rate is applied to at least minimum-weight capacity of the car, whether the weight is there or not. For instance, in the Corn Belt 36-foot stock cars have a minimum capacity of 22,000 pounds. This means that freight has to be paid on 22,000 pounds, or more if the weight exceeds that figure; hence the importance of having at least minimum capacity so as to avoid the payment of freight on weight which was not there.

The items of terminal charge, commission, and yardage are established and can not be affected by the shipper. Usually the feeding and watering in the yards is left to the commission men to whom the cattle are consigned. The animals are given hay and water and allowed a "good fill" before being offered for sale. Most of the cattle are sold the same day they arrive on the market. Comparatively few shipments of fat cattle in the Corn Belt originate so far from the market that it is necessary to unload and feed in transit.

Loading the car is an important factor for the shipper to consider. In doing so it is important to have the necessary weight, but still more important to have the space so well utilized that the cattle are "snug." Unused space increases the liability to injury.

The actual cost of loading depends upon the labor involved. An extra man along is usually good economy. In being driven to the station cattle see strange objects and are frightened very easily, and for this reason alone the services of an extra man may prove very valuable in keeping the drove together. Cattle should be driven with as little noise as possible.

Bedding the car is an essential to good shipping. It is not intended that it should furnish a comfortable place for the cattle to lie down, but should furnish good footing for them, so as to prevent slipping. Cattle well bedded come out of the car having a clean appearance, which is always attractive to the buyer.

Shrinkage, while not a direct cost in marketing, yet directly affects this cost. Shrinkage is not represented by an actual money outlay, as the shipper does not actually expend any money, yet the returns on a shipment are often affected by shrinkage to such an extent that it is often a factor in determining profit or loss.

All shippers desire to reduce shrinkage in transit to a minimum. It can be kept low by the proper feeding of the cattle just prior to shipment. During the 48 hours before shipping, feeds of high-protein content or laxative nature should be greatly decreased. This applies to such feeds as silage, legume hays, and protein concentrates.

Corn should be decreased about one-half during the last day of feeding. All dry roughages, with the exception of legume hays, can be supplied in unlimited amounts during this period.

Any feed that has the tendency to be "heating" to the animal should be reduced. Oats can be substituted for one-half the corn ration the last two days with good results. Molasses or any other sweet feed in the ration can be fed until shipping time without bad effects.

Salt should be provided at all times. It is bad practice to keep salt away from the cattle for some time and then salt them heavily just before shipping. This practice invariably causes scouring while in transit and the shipper will be the loser.

Cattle should receive their normal supply of water until possibly a few hours before shipping.

Shrinkage usually varies from 3 to 5 per cent of their weight, depending upon the shipping distance and the way the cattle are fed just prior to shipment.

FATTENING OF STEERS USUALLY PROFITABLE.

Though some feeders experienced losses in the fattening of cattle during the winters of 1918–19 and 1919–20, yet on an average for 5 years or more the industry has generally been decidedly profitable. Some feeders contend that they lose money year after year in feeding cattle, but as a rule signs of prosperity are noticeable on the farms where cattle feeding has played an important part in the farm operations.

Many so-called losses are classed as such because top market prices were not received for the crops that were fed to the cattle. It is entirely wrong, however, to charge the feeds at the top prices for the year, as comparatively few farmers are fortunate enough to dispose of their crops at the period of highest prices. It is not uncommon in normal times to receive prices for the crop fed even higher than top market prices, but this should not be expected.

The man who feeds cattle is marketing his crops as he feeds them, and therefore is justified in expecting a return equivalent to average market prices for the feeds. Even if he falls short of such return he has not necessarily experienced a loss. If a price above the cost of production is realized for feeds fed to cattle the feeding operation is successful. In other words, if cost of production rather than market values of feeds is used as the basis for determining profit or loss in cattle feeding, the fattening of cattle usually results in a profit.

It happens occasionally that the farmer who sells grain receives more for his corn than the farmer who feeds it to cattle, but on the average for a long period of years the man who feeds his crop and puts the valuable manure back on the land is the one who comes out ahead in the end.

Maintaining the fertility of the land is one of the most important problems with which the landowner has to deal, and it can best be solved by feeding the crops on the farm. The average grain farm is gradually declining in fertility, whereas the fertility of the livestock farm is practically maintained.

SUMMER FATTENING ON GRASS.

High-priced land suitable for grain production in the Corn Belt area can hardly be profitably kept for pasture for the production of beef for market. However, there are many farms having rough land that can be utilized best as a permanent pasture. Gains made by cattle on pasture are always the most economical. When "roughed" through the winter, largely on cheap roughages, they

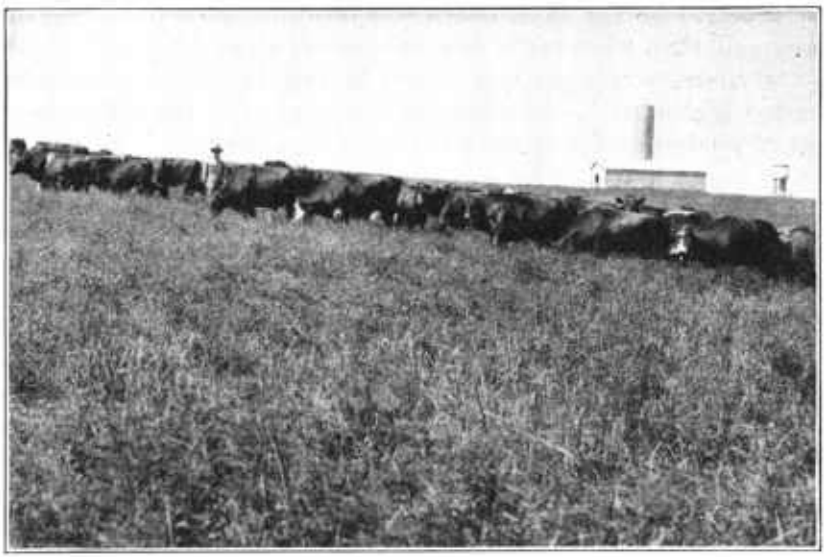

FIG. 12.—Steers on pasture in northern central Missouri.

can be marketed early the following fall at a cost materially lower than would result from dry-lot feeding.

Cattle to be finished in the summer on grass, with possibly the addition of a little corn or other supplement in the fall, should not be fed heavily during the winter. But they should not be allowed to lose weight during the winter months. If they can be kept in a healthy, thrifty condition during the winter months they will do better on grass the following summer than if heavily grain-fed during the winter.

Feeders purchased in the fall can be wintered satisfactorily on cornstalk fields, silage, straw, and hay. If silage is used and legume hay is not available the use of a small amount of cottonseed meal or linseed meal would be advisable.

STEER FATTENING ON GRASS.

There are no recent investigations which furnish data of much value on summer fattening on grass in the Corn Belt. However, some very valuable data have been derived from work carried on in the Southern States, which may be indirectly applicable to the Corn Belt. Though the pasture grasses of the South differ in many respects from those found in the Corn Belt area, yet their nutritive values compare favorably. Bulletin No. 777, United States Department of Agriculture, gives a detailed account of fattening steers on summer pasture in the South.

Four years of summer fattening of steers on grass in the South showed that the addition of 3.81 pounds of cottonseed cake, in addition to the pasture, produced a daily gain of 1.83 pounds per steer for a period of 122 days, which was one-third of a pound greater daily gain than when cattle received pasture alone.

The steers receiving a supplement invariably put on more finish, dressed higher, and sold higher to more than pay the difference in cost of production due to the addition of supplement.

METHODS OF FINISHING CATTLE ON GRASS.

The three methods of summer fattening that are practicable in the Corn Belt are as follows: Grass alone, grass and additional feed throughout the entire feeding period, and grass with additional feed the last few months of the feeding period.

The grass season is usually from May to November, inclusive, which is 7 months, or 214 days. Two acres of good pasture are usually allowed per animal. When grass alone is depended upon to put finish on the cattle, 214 days are too long for most of the Corn Belt, as the grazing season is at its best from June until October. After September the average pasture begins to decrease in value very rapidly, and cattle should be marketed at this time or given additional feed.

The addition of a supplement to a pasture should be determined largely by the grade of cattle used and the kind of pasture. Well-bred cattle utilize a supplement to greater advantage than common cattle. An abundance of good, cheap pasture would justify the use of pasture alone, but this is a condition not found to-day in many sections of the Corn Belt area.

FATTENING YEARLINGS ON BLUE-GRASS PASTURE AND SUPPLEMENTAL FEEDS.

The Missouri Agricultural Experiment Station reports (Bulletin 90) the results of 5 years' investigations, from May 1, 1903, to December 1, 1907, on fattening cattle on blue-grass pasture. The investigations were carried on with yearlings, 2-year-olds, and 3-year-

olds. As the different rations varied similarly with each age, only the results with the yearlings will be discussed here. The cattle used were native Missouri cattle of good quality and were fed practically 7 months, or about 210 days.

The rations used were: Corn alone, corn and linseed meal, and corn and cottonseed meal.

Corn supplemented with either cottonseed or linseed meal produced greater daily gains on yearling steers than corn alone, when fed in conjunction with pasture. The steers fed corn alone gained

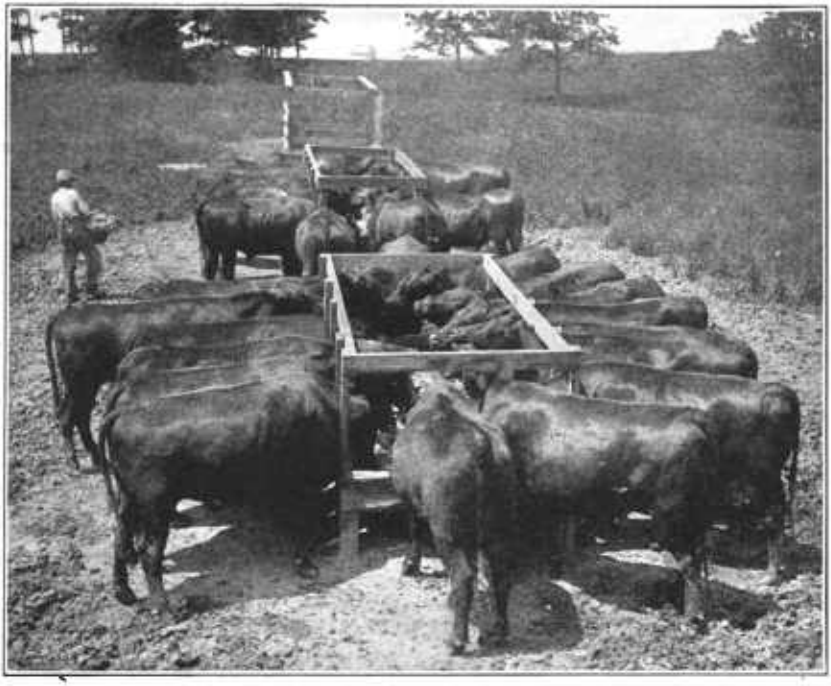

FIG. 13.—Summer fattening of steers on pasture and supplementary feeds in eastern Indiana.

2.03 pounds a day as against 2.22 pounds for linseed meal and 2.15 for cottonseed meal.

The cattle were fed all the grain they would consume in addition to the blue-grass pasture. When corn alone was fed the steers consumed 15.77 pounds of shelled corn a day; with 3.20 pounds of linseed meal a day the total grain consumption was 17.19 pounds; and with 2.93 pounds of cottonseed meal a day the total grain consumption per head per day was 16.46 pounds.

There was very little difference in the quantities of feed required to produce a pound of gain, 7.78 pounds of grain being required when no other supplement than corn was supplied; 7.76 pounds

when linseed meal was included; and 7.67 pounds when cottonseed meal was given.

Prevailing prices of corn and concentrates and the quality of cattle should largely determine the supplement to pasture, which might be corn alone, corn with a protein supplement, or the protein supplement by itself.

FIG. 14.—Shorthorn steers finished on corn and grass in central Illinois.

For Corn Belt conditions the following methods, with length of feeding period and amounts of supplemental feed, are suggested for 2-year-old steers:

TABLE 10.—*Suggested methods of fattening 2-year-old steers on grass and supplemental feeds in Corn Belt area.*

Method.	Length of grazing period.	Supplemental feed per day per steer.
	Days.	
Grass alone	150	
Grass and corn	210	Corn, 10 to 12 pounds.
Grass and cottonseed cake	210	Cake, 2½ to 4 pounds.
Grass and corn and cake or linseed meal	210	Corn, 8 to 10 pounds; cake or meal, 1 to 2 pounds.
Grass 210 days, and corn last 90 days	210	Corn, 12 to 15 pounds.
Grass 210 days, and corn and cake or meal last 90 days.	210	Corn, 10 to 12 pounds; cake or meal, 1½ to 3 pounds.

How To Do It

Do you want practical suggestions on how to build a silo, a hog house, a poultry house, a potato-storage house, or how to make a fireless cooker, or other farm convenience? Are you seeking ideas on how to prepare vegetables for the table, how to care for food in the home, how to bake bread and cake and other appetizing foods in an efficient and economical manner? Is there some practical question about your corn or wheat or cotton or other crops, or about your poultry or live stock, to which you are seeking an answer? The answers to thousands of such questions and practical suggestions for doing thousands of things about the farm and home are contained in over 500 Farmers' Bulletins, which can be obtained upon application to the Division of Publications, United States Department of Agriculture, Washington, D. C.

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